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VAX TO CRAY NASTRAN USER INTERFACE

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Albuquerque, NM 87119

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Air Force Systems Command
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The goal of this program is to overcome the difficulties in establishing fast and effective communication links between certain large computer systems. Previously, file transfer between PATRAN installed on the Silicon Graphics and on the VAX 8700, and NASTRAN installed on the CRAY-1S, was restricted because transferable files between these machines could not be easily produced; resulting in time-consuming and error-prone procedures. This software simplifies such procedures.

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1. OVERVIEW OF SILICON GRAPHICS/VAX/CRAY AND NASTRAN INTERFACE

The Air Force Weapons Laboratory ~~(AFWL)~~ has access to both the NASTRAN and PATRAN software systems for structural analysis investigations; however, these two codes are resident on separate computer systems at AFWL. NASTRAN is used to perform the bulk of large structural analysis research and is resident on the CRAY-1S. PATRAN is installed on a Silicon Graphics and allows depictions and animation of modal analysis results. The two software packages are complementary in function, and communication between them can be achieved through the GATEWAY facility. The GATEWAY links the AFWL04 VAX, the Silicon Graphics IRIS, and the CRAY through a common network protocol.

This document describes software resident on the VAX and CRAY computer systems which allows PATRAN animation of NASTRAN calculated modal shapes. This section contains general information which should be reviewed by all potential users. Section 2 outlines the step by step implementation of NASTRAN calculation and PATRAN animation. This approach is designated VAX/CRAY/VAX processing. The VAX/CRAY/VAX approach is appropriate regardless of whether the NASTRAN model was created on the Silicon Graphics using PATRAN or created on the VAX using an editor. Section 3 provides important notes on the use of the existing NASTRAN DMAP alter library, and Section 4 is an example computer session implementing VAX/CRAY/VAX processing as described in Section 2.

PREREQUISITES FOR NASTRAN USE:

The analyst should have:

(1) A Silicon Graphics IRIS User account,

(2) An AFWL04 VAX User account with GATEWAY privileges,

(3) An AFWL CRAY User account, and

(4) access to the following files:

on the VAX:

MODAL.COM,

MODAL.EXE

on the CRAY:

NASVAX,

NASGO,

NASGO2,

NASJOB1,

NASJOB2,

NASPRGEX,

MSET,

and NASALTR

It is strongly recommended that the analyst acquaint himself/herself with the operating systems of the VAX, the Silicon Graphics, and CRAY. Many unusual error conditions can occur on all machines, and these conditions are beyond the scope of the present document.*

*For additional help on the VAX or the CRAY, contact the consulting group at 844-8031. Additional help on the Silicon Graphics may be obtained from either the Silicon Graphics User Hotline (1-800-252-0222) or by contacting ATA at 505/247-8371.

2. SUMMARY TABLE FOR NASTRAN TO PATRAN VAX/CRAY/VAX PROCESSING

TABLE I
SUMMARY OF NASTRAN TO PATRAN
VAX/CRAY/VAX PROCESSING

SG:		
	Step 0:	Develop NASTRAN model
	Step 1:	Transfer model to VAX
VAX:		
	Step 2:	Translate model
CRAY:		
	Step 3:	Retrieve model and Run NASTRAN
	Step 4:	Run NASPAT
VAX:		
	Step 5:	Retrieve results
	Step 6:	Transfer file from VAX to Silicon Graphics IRIS
SG:		
	Step 7:	Translate results
	Step 8:	Run PATRAN

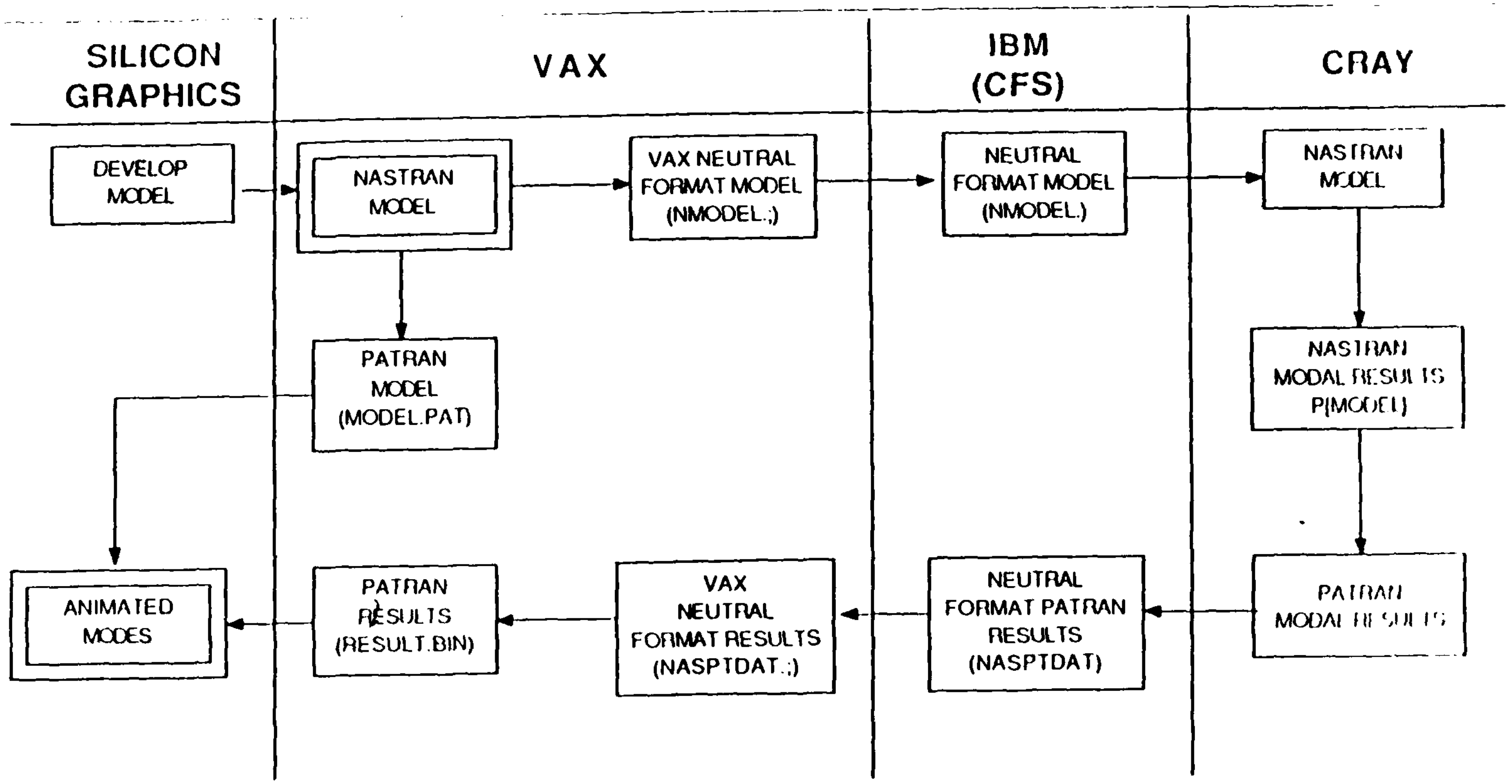

SILICON GRAPHICS
VAX
IBM (CFS)
CRAY
DEVELOP MODEL
NASTRAN MODEL
VAX NEUTRAL FORMAT MODEL (NMODEL.;)
NEUTRAL FORMAT MODEL (NMODEL.)
NASTRAN MODEL
PATRAN MODEL (MODEL.PAT)
NASTRAN MODAL RESULTS P(MODEL)
ANIMATED MODES
PATRAN RESULTS (RESULT.BIN)
VAX NEUTRAL FORMAT RESULTS (NASPTDAT.;)
NEUTRAL FORMAT PATRAN RESULTS (NASPTDAT)
PATRAN MODAL RESULTS

Figure 1. SG/VAX/CRA/VAX Processing Schematic

STEP 0: (SG) DEVELOP THE NASTRAN MODEL: The analyst may use PATRAN on the Silicon Graphics to develop a NASTRAN model. The model should be in upper case once on the VAX; during transport to the CRAY, it will be translated to lower case. Section 3 has some special notes on NASTRAN DMAP sequences.

STEP 1: (SG) TRANSFER MODEL TO VAX: Using a file transfer routine on the Silicon Graphics, transfer the 'PATRAN developed' NASTRAN model to the VAX.

STEP 2: (VAX) TRANSLATE MODEL: The NASTRAN model must be translated into a neutral format for transfer to the CRAY. The neutral format conversion is performed within MODAL.COM as follows:

```
S   @MODAL                --Start the 'Modal' procedure.
    (model file name)     --Supply the file name of the NASTRAN model.

                          A menu of options will appear on the screen.
    1                     --Choose option 1 to translate the model into  PATRAN
                            format.  The menu should re-appear
    2                     --Choose option 2 to translate the model into neutral
                            format.  The menu should re-appear.
    6                     --Choose option 6 to exit.
```

The model should now be stored under CFS and we are ready to log into the CRAY. The user may either log onto the CRAY directly or may reach the CRAY via the GATEWAY. These instructions assume that the GATEWAY will be used.

```
    CONNECT              --Initiate GATEWAY bridge to the CRAY.
    <CR>                 --Hit carriage return or enter user id if different.
    <CR>                 --Hit carriage return or enter charge code if
                           different.
    {CRAY Password}      --Provide correct ICN password.
```

The CRAY should now respond to the user.

If it is necessary to log off of the CRAY, type "^D" (<CONTROL>D) and control will be returned to the VAX.

If steps 0 through 2 have been completed, and the user has logged onto the CRAY, processing may continue with STEP 3.

STEP 3: (CRAY) RETRIEVE MODEL AND RUN NASTRAN: COSMOS deck 'NASGO' will retrieve the NASTRAN model file from CFS storage and translate it into lower case CRAY ASCII.

```
mass get nasgo           --Retrieve the NASGO COSMOS deck from CFS.
cosmos i=nasgo           --Run NASGO.
    {model name}         --Supply NASTRAN model name (up to six characters).
                           The NASTRAN model file will be stored both in local
                           file space and under CFS.
```

NASGO will present a current list of default NASTRAN run variables and prompt the user for instructions. The new user should type "help" for a list of all options.

set --Select an item by item update of current variable values either individually, (e.g., "SET 1 1000000) or all variables. The user should be sure to set item 7 (NASTRAN deck name) and item 2 (user CRAY account number). See also Section 3 of this document.

stop --Accept current variable values and proceed with NASTRAN job processing.

If NASGO encounters no errors, it will submit a job to run NASTRAN using the specified NASTRAN model. This job will appear in the CRAY job queue as "J{model}" where {model} is the name of the NASTRAN model file. The user may verify that this job is in the queue by typing the CTSS command "status."

When the NASTRAN job completes successfully, two files will appear in the user's local file space; these two files are "P{MODEL}" and "NASGO2." The appearance of NASGO2 in local file space indicates that the user may proceed to Step 4. {MODEL} is the name of the NASTRAN model file.

STEP 4: (CRAY) RUN NASPAT: The COSMOS deck 'NASGO2' submits a batch job to run NASPAT to translate NASTRAN results into PATRAN neutral format. It also stores these PATRAN neutral results under CFS for eventual transfer across the GATEWAY to the VAX.

```
cosmos i=nasgo2           --Run NASGO2.
    {CRAY user number}    --Specify the valid CRAY User ID number.
    {job time}            --Specify the maximum NASPAT job time in minutes.
```

NASGO2 will submit a job labeled "JNASPAT." This job will appear on the CRAY job queue when the user types "status." When "JNASPAT" has finished, a file labeled "NASDONE" should appear in local file space. The appearance of this file indicates that CRAY processing is now complete and the user should return to the VAX to run PATRAN.

```
^D                        --Log off from the CRAY (<Control>D).
```

STEP 5: (VAX) RETRIEVE RESULTS: The neutral format PATRAN results file must be retrieved from CFS storage via the GATEWAY. This is accomplished as follows: If the user has not activated the GATEWAY, 'NETON' should be executed as described under STEP 2.

```
S   MASS                  --Call the CFS MASS utility.
    {VAX Password}        --Supply the correct VMS password.
    ? GET NASPTDAT        --Request MASS to retrieve the PATRAN results file.
    ? END                 --Exit from MASS.
```

The neutral format PATRAN results file should now be under the name "NASPTDAT.;" in local file space.

STEP 6: (VAX) TRANSFER FILE FROM VAX TO SILICON GRAPHICS: Transfer take the file NASPTDAT.; to the silicon graphics for PATRAN execution.

STEP 7: (SG) TRANSLATE RESULTS: NASPAT on the Silicon Graphics may be used to process the neutral format PATRAN results file brought from the CRAY. The file is translated and divided into individual PATRAN binary results files (one for each mode). These files are the individual mode results to be animated by PATRAN.

STEP 8: (SG) RUN PATRAN: PATRAN is used for animation of the mode shapes calculated by NASTRAN. Animation requires both the original model translated into PATRAN format as well as the modal results in PATRAN format (Step 7).

```
$   PATRAN                 --Start PATRAN execution.
    GO                     --Tell PATRAN to get going.
    1                      --Select new data file.
    5                      --Select neutral data mode.
    2                      --Select input model.
    {PATRAN model name     --Specify neutral model file name.
    N                      --Neutral input IDs should not be offset.

    Y                      --Proceed.  (Answer "Y" to all queries.)
    4                      --Select results mode.
    1                      --Select external data.
    1                      --Select deformed shape.
    {PATRAN result file}   --Select  result file name.  Input the animation file
                             name desired.
    5                      --Animate mode.
    Y                      --Type "Y" to repeat animation, "N" to stop.
    8                      --End.
```

5	--End.
6	--End.

The preceding PATRAN command sequence is given for quick reference only. Consult the PATRAN manual for all command options.

3. EXAMPLES AND EXTRA FEATURES

NASTRAN DMAP INSTRUCTIONS:

To animate any mode of a structural model, it is necessary to generate a modal displacement file. NASTRAN provides this capability through the use of DMAP instructions. DMAP card sequences instruct the NASTRAN processor to calculate, save, or manipulate data in its internal data arrays. For modal animation purposes, NASTRAN must be instructed to save modal displacement information for each requested mode.

USING THE CRAY ALTER LIBRARY, 'NASALTR:'

A library of standard CRAY DMAP card sequences has been established on the CRAY. This library is named 'NASALTR' and contains sequences for several analysis modes. The CRAY COSMOS decks described in this document access the NASALTR library when constructing the user's NASTRAN job. This utility allows the user to code a NASTRAN deck without including actual DMAP commands. Instead, the user selects the proper DMAP sequence from the NASALTR library at job submit time and the COSMOS deck NASGO writes the appropriate DMAP commands into the user's model immediately preceding the '*cend' card.

WARNING: The user must either choose the appropriate alter deck from the NASALTR library or code in the necessary DMAP commands. If the DMAP sequence is not included when the job is submitted, NASTRAN will run without producing modal displacement results.

EXAMPLE:

The following simple example should be studied and the user's NASTRAN decks tailored accordingly. NASTRAN solution sequence 3 combined with alter deck 'alter1' produces modal displacement results which may be animated by PATRAN on the VAX. The NASTRAN executive deck for model 'x' has been written as

```
*id x

*sol 3

*cend
```

When the COSMOS deck NASG01 runs on the CRAY, the user sets the alter deck name (index 10) to "alter1" and the alter library name (index 3 to "nasaltr." Before the actual NASTRAN job is submitted to the CRAY batch queue, it is rewritten to include the specified alter as follows:

```
*id x
*sol 3
$  MSA/NASTRAN ALTER
$  FOR SOLUTION 3 (Normal Modes)
$  USE ONLY IF DISPLACEMENTS ARE IN GLOBAL COORDINATES
ALTER   450 $
OUTPUT2 OUGV1//-1/11V,N,Z $
$  CEND
$  DISP ■ ALL
*cend
```

CONTENTS OF THE NASALTER LIBRARY:

The following is a reference library of the contents of the NASALTR NASTRAN alter deck library on the CRAY.

```
---------- alter1 ----------
$   MSC/NASTRAN ALTER
$   FOR SOLUTION 3 (Normal Modes)
$   USE ONLY IF DISPLACEMENTS ARE IN GLOBAL COORDINATES
ALTER   450 $
OUTPUT2 OUGV1//-1/11/V,N,Z $
$   CEND
$   DISP = ALL

---------- alter2 ----------
$   MSC/NASTRAN ALTER
$   FOR SOLUTION 3 (Normal Modes)
$   FORM THE TRANSFORMATION MATRIX TRANSGB TO
$   TRANSFORM DISPLACEMENTS INTO GLOBAL RECTANGULAR SYSTEM
ALTER      450 $
MATMOD     CSTM,SIL,BGPDT,,,/TRANSGB,/5//-1 $
MPYAD      TRANSGB, UGV/UGVBASIC $
SDR2       CASECC,,,,EQEXIN,,,,,LAMA,,UGVBASIC,,/
```

```
LAMA,,UGVBASIC,,/
               ,,OUG1VPAT,,,/SOLTYPE/S,N,NOSORT2/V,N,NOCOMP S
OUTPUT2        OUGV1PAT,OES1//-1/11/V,N,ZS
$     CEND
$     DISP    = ALL
$     STRESS  = ALL

---------- alter3 ----------
$     MSC/NASTRAN ALTER
$     FOR SOLUTION 5 (Buckling)
$     USE ONLY IF DISPLACEMENTS ARE IN GLOBAL COORDINATES
ALTER          142 $
OUTPUT2        OPHIG//-1/11V,N,Z $
$     CEND
$     DISP    = ALL

---------- alter4 ----------
$     MSC/NASTRAN ALTER
$     FOR SOLUTION 24 (Statics)
$     USE ONLY IF DISPLACEMENTS ARE IN GLOBAL COORDINATES
ALTER          188 $
OUTPUT2        OUGV1,OES1X//-1/11/V,N,Z $
$     CEND
$     STRESS(VONM) = ALL
$     DISP         = ALL
```

```
---------- alter5 ----------
$   MSC/NASTRAN ALTER
$   FOR SOLUTION 24 (Statics) - Strain Energy Recovery
$   USE ONLY IF DISPLACEMENTS ARE IN GLOBAL COORDINATES
ALTER       190 $
OUTPUT2     OUGV1,ONRGY1,OESIX//-1/11/V,N,Z $
$   CEND
$   ESE    = ALL
$   DISP   = ALL
$   STRESS = ALL

---------- alter6 ----------
$   MSC/NASTRAN ALTER
$   FOR SOLUTION 24 (Static) - Grid Point Force Recovery
$   USE ONLY IF DISPLACEMENTS ARE IN GLOBAL COORDINATES
ALTER       193 $
OUTPUT2     OUGV1,OGPFB1//-1/11/V,N,Z $
$   CEND
$   DISP         = ALL
$   GPFORCE      = ALL

---------- alter7 ----------
$   MSC/NASTRAN ALTER
$   FOR SOLUTION 24 (Statics) - Element Strain Recovery
$   USE ONLY IF DISPLACEMENTS ARE IN GLOBAL COORDINATES
ALTER       215 $
```

```
OUTPUT2     OUGV1,OSTR2//-1/11/V,N,Z $
$   CEND
$   DISP               = ALL
$   STRAIN(FIBER,VONM) = ALL

---------- alter8 ----------
$   MSC/NASTRAN ALTER
$   FOR SOLUTION 24 (Statics) - Local Displacements to Global System
$   USE ONLY IF DISPLACEMENTS ARE IN GLOBAL COORDINATES
$   FORM THE TRANSFORMATION MATRIX TRANSGB TO
$   TRANSFORM DISPLACEMENTS INTO GLOBAL RECTANGULAR SYSTEM
ALTER       187 $
MATMOD      CSTM,SIL,BGPDT,,,/TRANSGB,/5//-1 $
MPYAD       TRANSGB,UGV,/UGVBASIC $
SDR2        CASECC,,,,EQEXIN,,,,,,,UGVBASIC,,/
            ,,OUG1VPAT,,,/STATICS/S,N,NOSORT2/V,N,NOCOMP $
OUTPUT2     OUGV1PAT,OES1X//-1/11/V,N,Z$
$   CEND
$   DISP   = ALL
$   STRESS = ALL

---------- alter9 ----------
$   MSC/NASTRAN VERSION 63 ALTER
$   FOR SOLUTION 27 (Direct Transient Analysis)
$   USE ONLY IF DISPLACEMENTS ARE IN GLOBAL COORDINATES
ALTER       1 $
```

```
OUTPUT2     ,,,,//C,N,-1/C,N,11/V,N,Z $

ALTER       449 $

OUTPUT2     OUGV1,OES1//C,N,0/C,N,11/V,N,Z$

$   CEND

$   DISP   = ALL

$   STRESS = ALL


---------- alter10 ---------

$   MSC/NASTRAN VERSION 63 ALTER

$   FOR SOLUTION 27 (Direct Transient Analysis)

ALTER       1 $

OUTPUT2     ,,,,//C,N,-1/C,N,11/V,N,Z $

ALTER       449 $

MATMOD      CSTM,SIL,BGPDT,,,/TRANSGB,/5//-1 $

MPYAD       TRANSGB,UGV,/UGVBASIC $

SDR2        CASEXX,,,,EQEXIN,,,,,,,UGVBASIC,,/

            ,,OUG1VPAT,,,/SOLTYPE/S,N,NOSORT2/V,N,NOCOMP $

OUTPUT2     OUGV1PAT,OES1//C,N,0/C,N,11/V,N,Z$

$   CEND

$   DISP   = ALL

$   STRESS = ALL


---------- alter11 ---------

$   MSC/NASTRAN ALTER

$   FOR SOLUTION 47 (Cyclic Symmetry - Statics)

$   USE ONLY IF DISPLACEMENTS ARE IN GLOBAL COORDINATES
```

```
ALTER      1 $
OUTPUT2    ,,,,//C,N,-1/C,N,11/V,N,Z $
ALTER      268 $
OUTPUT2    OUGV1,OES1X//0/11/V,N,Z$
$   CEND
$   DISP   = ALL
$   STRESS = ALL

---------- alter12 ---------
$   MSC/NASTRAN ALTER
$   FOR SOLUTION 47 (Cyclic Symmetry - Statics)
$   FORM THE TRANSFORMATION MATRIX TRANSGB TO
$   TRANSFORM DISPLACEMENTS INTO GLOBAL RECTANGULAR COORDINATES
ALTER      1 $
OUTPUT2    ,,,,//C,N,-1/C,N,11/V,N,Z $
ALTER      268 $
MATMOD     CSTM,SIL,BGPDT,,,/TRANSGB,/5//-1 $
MPYAD      TRANSGB,FUGV,/UGVBASIC $
SDR2       CASEBK,,,,EQEXIN,,,,,,,UGVBASIC,,/
           ,,OUGV1PAT,,,/C,N,STATICS/S,N,NOSORT2/V,N,NOCOMP $
OUTPUT2    OUGV1PAT,OES1X//0/11/V,N,Z$
$   CEND
$   DISP   = ALL
$   STRESS = ALL

---------- alter13 ---------
$   MSC/NASTRAN ALTER
$    FOR SOLUTION 61 (Superelement Statics)
$    USE ONLY IF DISPLACEMENTS ARE IN GLOBAL COORDINATES
ALTER       1 $
OUTPUT2     ,,,,//C,N,-1/C,N,11/V,N,Z $
ALTER       649 $ (FOR NASTRAN VERSION 64, USE ALTER 664)
OUTPUT2     OUGV1,OES1//0/11/V,N,ZS
$    CEND
$    DISP   = ALL
$    STRESS = ALL

---------- alter14 ---------
$    MSC/NASTRAN ALTER
$    FOR SOLUTION 64 (Geometric Nonlinear)
$    USE ONLY IF DISPLACEMENTS ARE IN GLOBAL COORDINATES
ALTER       1 $
OUTPUT2     ,,,,//C,N,-1/C,N,11/V,N,Z $
ALTER       285 $
OUTPUT2     OUGV1,OES1X//C,N,0/C,N,11/V,N,ZS
$    CEND
$    DISP   = ALL
$    STRESS = ALL

---------- alter15 ---------
$    MSC/NASTRAN ALTER
$    FOR SOLUTION 64 (Geometric Nonlinear) -  Local  Displacements  to
Global System
$    FORM THE TRANSFORMATION MATRIX TRANSGB TO
$   TRANSFORM DISPLACEMENTS INTO GLOBAL RECTANGULAR COORDINATES
ALTER       1 $
OUTPUT2     ,,,,//C,N,-1/C.N,11/V,N,Z $
ALTER       285 $
MATMOD      FCSTMS,FSILS,FBGPDT,,,/TRANSGB,/5//-1 $
MPYAD       TRANSGB,FUGV,/UGVBASIC $
SDR2        CASEXX,,,,FEQEXINS,,,,,,,UGVBASICS../
            ,,OUGV1PAT,,,/APP/S,N,NOSORT2/V,N,NOCOMP $
OUTPUT2     OUGV1,OES1X//C,N,0/C,N,11/V,N,Z$
$   CEND
$   DISP   = ALL
$   STRESS = ALL


---------- alter16 ---------
$   MSC/NASTRAN ALTER
$   FOR SOLUTION 66 (Material Nonlinear)
$   USE ONLY IF DISPLACEMENTS ARE IN GLOBAL COORDINATES
ALTER       1 $
OUTPUT2     ,,,,//C,N,-1/C,N,11/V,N,Z $
ALTER       940 $ (FOR NASTRAN VERSION 64, USE ALTER 662)
OUTPUT2     OUGV1,OES1//0/C,N,11/V,N,Z$
$   CEND
$   DISP   = ALL
$   STRESS = ALL


---------- alter17 ---------
$   MSC/NASTRAN ALTER
$    FOR SOLUTION 66 (Material Nonlinear)  -  Local  Displacements  to
Global System
$    FORM THE TRANSFORMATION MATRIX TRANSGB TO
$    TRANSFORM DISPLACEMENTS INTO GLOBAL RECTANGULAR COORDINATES
ALTER       1 $
OUTPUT2     ,,,,//C,N,-1/C,N,11/V,N,Z $
ALTER       940 $
MATMOD      CSTMS,SILS,BGPDTS,,,/TRANSGB,/5//-1 $
MPYAD       TRANSGB,UGV,/UGVBASIC $
SDR2        CASEDR,,,,EQEXIN,,,,,PJ1,,UGVBASIC,,/
            ,,OUGV1PAT,,,/C,N,STATICS/S,N,NOSORT2/V,N,NOCOMP $
OUTPUT2     OUGV1PAT,,,/OESL1//C,N,0/C,N,11/V,N,Z$
$    CEND
$    DISP   = ALL
$    STRESS = ALL


---------- alter18 ---------
$    MSC/NASTRAN ALTER
$    FOR SOLUTION 77 (Cyclic Summetry Buckling)
$
$    PRE-STRESS STATE
ALTER       1 $
OUTPUT2     ,,,,//C,N,-1/C,N.11/V,N,Z $
ALTER       136 $
MATMOD      CSTMS,SILS,BGPDT.,,/TRANSGB,/5//-1 S
MPYAD       TRANSGB,UGV,/UGVBASIC $
SDR2        CASECC,,,,EQEXIN.,,,,,,PHIGBASIC,./
```

```
            ,,OUGV1PHIG.,,/SOLTYPE/S.N.NOSORT2/V.N.NOCOMP $
EQUIV       OBES1,OES1PAT/ADDPDA $
OUTPUT2     OUGV1PHIG,OES1PAT/C,N,0/C,N,11/V,N,Z $
$
$   CEND
$   DISP   = ALL
$   STRESS = ALL

---------- alter19 ---------
$   MSC/NASTRAN ALTER
$   FOR SOLUTION 89 (Superelement Transient Heat Transfer)
ALTER       1    $
OUTPUT2     ,,,,//C,N,-1/C,N,11/V,N,Z $
ALTER       252  $ (FOR NASTRAN VERSION 64, USE ALTER 966)
OUTPUT2     OUGV1,OES1//O11/V,N,Z$
$   CEND

---------- alter20 ---------
$  ----------------- MSET --------------------------
$  CSA Engineering, Inc.
$
$ Alter for MSC/NASTRAN version 65, SOL 63
$ Writes strain energies on OUTPUT2 file for post-processing
$ along with mass info in OUTPUT4 format.
$ WG, Dec 85
$ Rev Mar 86 V65
$ Rev Apr 86 -- handle alternate coord sys WG
$ Rev May 86 -- more DBFETCHs so it works with restart WG
$ Rev Sep 86 -- PARAM,NOSEPOST
$
$ Provide file assignments for units 11 and 12 as follows (VAX):
$
$       $ ASSIGN [directory]job.OUS FOR011   (strain energy)
$       $ ASSIGN [directory]job.MAS FOR012   (weight)
$       $ ASSIGN [WG.DMAP]CASECC.OU2 FOR015  (read only)
$
$ Unit numbers may be changed by
$
$     PARAM   ESEUNIT    xx   (default 11)
$     PARAM   WTUNIT     xx   (default 12)
$
$     PARAM   NOSEPOST  -1   will skip all calculations in this alter
$
$ If ESE= is included in the Case Control deck, then strain energies
$ will be printed in the  usual  manner.  All  strain  energies  are
written
$ to the auxiliary file irrespective of any ESE request.
$
$ This alter deals only with the residual structure.  Upstream
$ superelement energies are not considered.
$
$ ALTER 1120    $ V65
ALTER 1081     $ V63
PARAM    //NOP/V,Y,NOSEPOST=1 $
```

```
COND     NOSEPOST,NOSEPOST $
$
$ Generate grid point mass vector
$
DBFETCH  /MGG,,,,/MODEL/0/0 $
DBFETCH  /BGPDTS,EQEXINS,CSTMS,,/0/0 $
DIAGONAL MGG/MGGDIAGL $
VECPLOT  ,,BGPDTS,EQEXINS,CSTMS,,/DGX6T/-1//4 $
MATGEN   ,/PMASS/6/6/1/5 $
PARTN    DGX6T,,PMASS/DGX1T,,,/1 $
TRNSP    DGX1T/DGX1 $
MPYAD    MGG,DGX1,/MASS $
PARAMR   //DIV/V,N,WTMASSI/1./V,Y,WTMASS $
PARAMR   //COMPLEX//WTMASSI/0./V,N,WTMASSC $
ADD      MASS,/WEIGHTL/WTMASSC $
$
$ Generate strain energy data block
$
INPUTT2  /DUMCASE,,,,//15/ $
DBFETCH  /UGVS,KELM,KDICT,ECTS,GPECT/0/0 $
DBFETCH  /PG,QGS,SILS,GPLS,VELEM/0/0 $
GPFDR
DUMCASE,UGVS,KELM,KDICT,ECTS,EQEXINS,GPECT,PG,QGS,BGPDTS,SILS,
         CSTMS,VELEM/ONRGY1,OGPFB1/APP1/0.0 $
VECPLOT  WEIGHTL,BGPDTS,EQEXINS,CSTMS,CASECC,/WEIGHT/0/0/1 $
VECPLOT  MGGDIAGL,BGPDTS,EQEXINS,CSTMS,CASECC,/MGGDIAG/0/0/1 $
VECPLOT  UGVS,BGPDTS,EQEXINS,CSTMS,CASECC,/UGVSB/0/0/1 $
```

```
DBFETCH  /LAMA,,,,/0/0 $

OUTPUT2  LAMA,ONRGY1,BGPDTS,GPLS,//0/V,Y,ESEUNIT=11 $

OUTPUT4  WEIGHT,MGGDIAG,UGVSB,,//0/V,Y,WTUNIT=12 $

LABEL    NOSEPOST $
```

4. EXAMPLE OF VAX/CRAY/VAX PROCESSING

The following pages represent a log of an actual computer session which produced animated modal results. This example follows the outline of VAX/CRAY/VAX processing presented in Section 2. For the sake of brevity and legibility, the following conventions have been adopted in the log:

(1) All user input is underlined to distinguish it from computer responses.

(2) On some occasions, actual user input is not echoed in the log. These blank inputs are either passwords which do not appear on the screen during processing single carriage returns <CR>.

THE EXAMPLE MODEL:

Three PATRAN renderings of the example model are appended to the end of the computer session log. The wire mesh and first hidden line drawing represent the undeformed model, while the second hidden line drawing is a highly exaggerated depiction of a calculated structural mode.

For moderately complex models such as this one, the benefits of modal animation become clear. Without animation, careful comparison of the deformed and undeformed node locations may not easily reveal all of the modal analysis information present in these plots. However, with modal animation, the same information is conveyed in a few seconds rather than a few hours.

If double quotes are shown during data entry for program NASPRGEX in the printout, then a carriage return was typed.

```
neton

.............................................................................
If there are any problems, notify Brian Ridout at 844-1654.
MAIL to: XNET2::RIDOUT.
.............................................................................

icn password: ____________
000 znumber=001995   class=U   charge=00003434   distribution=
000 You are now authorized

@modal

  >> This is the DCL procedure "MODAL".  <<
  >> "MODAL" performs all data and model <<
  >> translations required for NASTRAN/  <<
  >> PATRAN  CRAY/VAX  processing.       <<

  >>     APPLIED TECHNOLOGY ASSOCIATES <<
  >>            December,1985          <<

What is the name of the NASTRAN model file ?: plate.dat

                   >>> CURRENT MODEL IS "PLATE.DAT" <<<

                    OPTION
                    ------
                       1   NASTRAN MODEL ---> PATRAN MODEL
                           Translate NASTRAN model into PATRAN format.

                       2   VAX MODEL ---> CRAY MODEL
                           Translate model into machine-independent format.
```

```
                        3   CRAY MODEL ---> VAX MODEL
                            Translate model from machine-independent format.

                        4   CRAY RESULTS ---> VAX RESULTS
                            Translate PATRAN result file to VAX format.

                        5   SELECT NEW MODEL

                        6   EXIT

OPTION: 2

RUNNING STEXT

%DELETE-I-FILDEL, DUA1:[JAMES.NASTRAN]NMODEL.;1 deleted (12 blocks)

  >> The model will now be put on mass                <<
  >> storage as NMODEL.                               <<

%DCL-I-SUPERSEDE, previous value of SYS$INPUT has been superseded
VMS LOGIN PASSWORD:
 000 87/07/09 11:16:17.453  STORE NMODEL.:/001995/NMODEL.
 001 (115620B BITS)

                    >>> CURRENT MODEL IS "PLATE.DAT" <<<

                     OPTION
                     ------
                        1   NASTRAN MODEL ---> PATRAN MODEL
                            Translate NASTRAN model into PATRAN format.

                        2   VAX MODEL ---> CRAY MODEL
                            Translate model into machine-independent format.

                        3   CRAY MODEL ---> VAX MODEL
                            Translate model from machine-independent format.
```

```
                   4  CRAY RESULTS ---> VAX RESULTS
                      Translate PATRAN result file to VAX format.

                   5  SELECT NEW MODEL

                   6  EXIT

OPTION: 6

ATA $ mass
VMS LOGIN PASSWORD: ____________
? LIST

     NODE NAME: 001995
     DESCENDANTS:
         JCLNAST
         JCLPREP
         NASTEXE
         RATSEXE
         NASTPLOT
         PLOTEXE
         PLTPREP
         NPATEXE
         NASGO
         NASGO1
         NASGO2
         NASPRGEX
         NASALTR
         NASPRG
         NASPAT
         NASPATEX
         NASVAX
         NASJOB1
         NASJOB2
         APC
         CPAT
         TAPE999
         TAPE909
         TAPE199
         PLTX
         MHDCBE
         MHDCB1
         OUTPUT                  DIR
         NASALTRS
         NASMODEL
         NASGOLD2
         NASGOLD1
         NMODEL.
         MSET.FOR
         MSET
         PLATE
         TAPE7
         DBPLATE                 DIR
         TAPE6
         MPLATE
         OPLATE
         APLATE
? END

ATA $ connect

 CONNECT Version 4.1  12/86
   USE LOWER CASE FOR CTSS
   DEFAULTS MAY BE USED FOR USER NUMBER AND CHARGE CODE
   THE DEFAULT WILL BE THE VALUES IN THE DP
     AUTHORIZATION FILE
     (SHOWN BY NETON, WHICH MUST BE RUN BEFORE CONNECT)

CTSS USER NUMBER (DEFAULT - NETON USER NUMBER): ____________

CTSS CHARGE CODE (DEFAULT - NETON CHARGE CODE): ____________
```

```
ICN PASSWORD: ___________

 V b07f 0180.420 ACTIVE  A
NIL
files
    6014 rw  logmlgy3
    5526 rw  logtlgy3
    2744 re  nasgo
  107615 re  nasprgex
    1011 rw  plate
      73 rw  tape7

 all done

cosmos i=nasgo

10:57:13 000:00.003 v07/09/87 AFWLCC cosmos 2.4 ar3 001995  mic  ***  +cosmva0
*** nasgo james m *** page 1


                           1 */   >> THIS IS COSMOS DECK "NASGO".  <<
                           2 */   >> IT IS DESIGNED TO RETRIEVE A  <<
                           3 */   >> NASTRAN MODEL WHICH HAS BEEN  <<
                           4 */   >> SENT TO CFS FROM THE VAX.     <<
                           5 */
                           6 */   >> APPLIED TECHNOLOGY ASSOCIATES <<
                           7 */   >>        December,1985          <<
                           8 */
                           9 */
                          10 */   >> GET THE MODEL FILE (IN STEXT FORMAT) <<
                          11 */   >> FROM MASS STORAGE FILE "NMODEL."     <<
                          12 */
10:57:15 000:00.165       13 *mass get nmodel.
000 87/07/09 10:57:46.852  get nmodel.:/001995/nmodel.
001 (115620b bits) 87/07/07 09:45:42.837
10:57:19 000:00.440         all done
```

```
10:57:19 000:00.442     14 *files nmodel.
                          error in input line.
10:57:21 000:00.544        all done
10:57:21 000:00.547     15 *if lastmsg .has. "none" then go to nomodel
                        16 */
                        17 */   >> ASK USER FOR THE MODEL NAME <<
                        18 */
10:57:21 000:00.557     19 *let query=\lf\_"What is the NASTRAN model name?   {up
                           to six characters}"
                        plate

10:57:21 000:00.565     20 *let i=getmsg(\query\)
10:57:26 000:00.614     21 *let modname=msg
                        22 */
                        23 */   >> TRANSLATE THE MODEL INTO CRAY ASCII <<
                        24 */   >> FORMAT AND CONVERT TO LOWER CASE.   <<
                        25 */
10:57:26 000:00.622     26 *ntext nmodel. ascmodel
10:57:28 000:00.715        all done
                        27 */
                        28 */   >> CONVERT THE NASTRAN DECK TO LOWER CASE  <<
                        29 */
10:57:28 000:00.721     30 *trans i=(ascmodel,cray),o=(\modname\,cray),lc
10:57:32 000:00.807        all done
                        31 */
                        32 */   >>STORE THE MODEL UNDER CFS.              <<
                        33 */
10:57:32 000:00.813     34 *mass store \modname\
000 87/07/09 10:58:03.949  store plate:/001995/plate
001 (76400b bits)
10:57:37 000:01.086        all done
10:57:37 000:01.088     35 *destroy nmodel. ascmodel
10:57:38 000:01.140        all done
                        36 */
                        37 */   --------------------------------------
                        38 */   >> "NASGO" IS FINISHED.                   <<
```

```
                         39 */   >> THE NASTRAN MODEL IS UNDER CFS   <<

10:57:38 000:01.148 v07/09/87 AFWLCC cosmos 2.4 ar3 001995 mic *** .cosmva0  ---
nasgo james m *** page 2

                         40 */   >> STORAGE AND IN LOCAL FILE SPACE. <<
                         41 */   >> READY TO RUN "NASGO1"!     <<
                         42 */   -------------------------------------
                         43 */
10:57:39 000:01.198      44 *go to end1
10:57:39 000:01.205      57 *end1:
                         58 */  >> THIS IS COSMOS DECK "NASGO1". <<
                         59 */  >> IT IS DESIGNED TO EXECUTE THE FIRST <<
                         60 */  >> PHASE OF NASTRAN/PATRAN VAX/CRAY    <<
                         61 */  >> MODAL ANALYSIS.  "NASGO1" WRITES    <<
                         62 */  >> AND SUBMITS A NASTRAN JOB.    <<
                         63 */
                         64 */  >> APPLIED TECHNOLOGY ASSOCIATES <<
                         65 */  >>  November, 1985   <<
                         66 */
                         67 */
10:57:40 000:01.261      68 *select messages=short
10:57:40 000:01.265      69 *let iero="no"
                         70 */
                         71 */   >> SEARCH FOR THE NASPROG EXECUTABLE <<
                         72 */
10:57:40 000:01.273      73 *let errorfile="nasprgex"
10:57:40 000:01.279      74 *files nasprgex
                           none
10:57:42 000:01.391          all done
10:57:42 000:01.393      75 *if lastmsg .has. "none" then mass get nasprgex
000 87/07/09 10:58:13.217  get nasprgex/root:/001995/nasprgex
001 (10761500b bits) 87/06/11 11:23:26.993
10:57:47 000:01.673          all done
10:57:47 000:01.676      76 *files nasprgex
                             107615 re  nasprgex
```

```
10:57:49 000:01.780        all done
10:57:49 000:01.782     77 *if lastmsg .has. "none" then go to missingfile
                        78 */
                        79 */   >> RUN NASPROG <<
                        80 */
10:57:49 000:01.791     81 *select extralines=tty
10:57:49 000:01.795     82 *nasprgex

                          No tape7 found...


--------------------------------------------------
INDEX  DESCRIPTIONCURRENT VALUE

10:58:02  000:02.689 v07/09/87 AFWLCC cosmos 2.4 ar3 001995 mic *** +cosmva0 ***
nasgo james m *** page 3

 1    Memory Coresize      { 6 digits }   300000
 2    User ID number       { 6 digits }   000000
 3    Alter Library Name                  nasaltr
 4    Printer Device                      0
 5    Checkpoint Restart Name             0
 6    Database Restart Name               0
 7    NASTRAN deck name
 8    Execution Time Limit {minutes}      10
 9    Job Priority   { 1.00 to 1.99 }     1.00
10    Alter Deck Name                     0
11    Class              { a, b, or c }   a
12    MSET run?     {0=No, 1=Yes}         0

--------------------------------------------------

**** Option?  Type "help" for help
  ?
 + "set"
   > Memory Coresize    { 6 digits }     CURRENTLY =  300000     <CR> to keep
   ?
+  "100000"
    > User ID number      { 6 digits }       CURRENTLY =  000000      <CR> to keep
   ?
+  "001995"
    > Alter Library Name                     CURRENTLY =  nasaltr     <CR> to keep
   ?
+  ""
    > Printer Device                         CURRENTLY =  0           <CR> to keep
   ?
+  ""
    > Checkpoint Restart Name                CURRENTLY =  0           <CR> to keep
   ?
+  ""
    > Database Restart Name                  CURRENTLY =  0           <CR> to keep
   ?
+  ""
    > NASTRAN deck name                      CURRENTLY =              <CR> to keep
   ?
+  "plate"
    > Execution Time Limit (minutes)         CURRENTLY =  10          <CR> to keep
   ?
+  "2"
    > Job Priority  { 1.00 to 1.99 }         CURRENTLY =  1.00        <CR> to keep
   ?
+  ""
    > Alter Deck Name                        CURRENTLY =  0           <CR> to keep
   ?
+  ""
    > Class          { a, b, or c }          CURRENTLY =  a           <CR> to keep
   ?
+  ""
    > MSET run?      (0=No, 1=Yes)            CURRENTLY =  0           <CR> to keep
   ?
+  "1"
```

```
-----------------------------------------------

11:01:07 000:07.153 v07/09/87 AFWLCC cosmos 2.4 ar3 001995 mic *** +cosmva0  ***
nasgo james m *** page 4

INDEX  DESCRIPTION                    CURRENT VALUE

                        1   Memory Coresize    { 6 digits }   100000
                        2   User ID number     { 6 digits }   001995
                        3   Alter Library Name                nasaltr
                        4   Printer Device                    0
                        5   Checkpoint Restart Name           0
                        6   Database Restart Name             0
                        7   NASTRAN deck name                 plate
                        8   Execution Time Limit {minutes}    2
                        9   Job Priority  { 1.00 to 1.99 }    1.00
                       10   Alter Deck Name                   0
                       11   Class              { a, b, or c }   a
                       12   MSET run?     {0=No, 1=Yes}       1

-----------------------------------------------

    **** Option?  Type "help" for help
   ?
 + "stop"

    >>>>>  TAPE7 has been created
    stop
   nasprgex ctss time      2.116      seconds
   cpu=      .061    i/o=     9.425    memory time=      .183
11:01:37 000:08.809            all done
11:01:37 000:08.812        83 *select extralines=none
                           84 */
                           85 */
                           86 */  >> DETERMINE WHETHER THIS IS A RATS RUN <<
                           87 */
```

```
11:01:37 000:08.821       88 *files tape8
                             none
11:01:39 000:08.937           all done
11:01:39 000:08.939       89 *if lastmsg .has. "none" then go to normal
11:01:39 000:08.954      112 *normal:
                         113 */
                         114 */  >> THIS IS A NORMAL NASTRAN RUN <<
                         115 */
11:01:39 000:08.959      116 *let input7="tape7"
                         117 */
                         118 */  >> READ IN THE PROCESSING PARAMETERS FROM <<
                         119 */  >> THE TAPE7 FILE GENERATED BY NASPROGE.   <<
                         120 */
11:01:39 000:08.970      121 *qed \input7\\lf\11\lf\end
                                12 lines. (a) tape7
                              100000       Memory Coresize   { 6 digits }
11:01:42 000:09.131           all done
11:01:42 000:09.134      122 *if lastmsg .has. "abort" then go to aborted
11:01:42 000:09.140      123 *let temp=rplcc(lastmsg," ")
11:01:42 000:09.148      124 *let coresize=getsym(temp,1)
11:01:42 000:09.154      125 *qed \input7\\lf\21\lf\end

11:01:43 000:09.214 v07/09/87 AFWLCC cosmos 2.4 ar3 001995 mic *** +cosmva0  ***
nasgo james m *** page 5

                                12 lines. (a) tape7
                              001995       User ID number    { 6 digits }
11:01:45 000:09.319           all done
11:01:45 000:09.322      126 *let temp=rplcc(lastmsg," ")
11:01:45 000:09.329      127 *let userid=getsym(temp,1)
11:01:45 000:09.336      128 *qed \input7\\lf\31\lf\end
                                12 lines. (a) tape7
                              nasaltr      Alter Library Name
11:01:48 000:09.497           all done
11:01:48 000:09.499      129 *let temp=rplcc(lastmsg," ")
11:01:48 000:09.507      130 *let alterlibrary=getsym(temp,1)
```

```
11:01:48 000:09.513      131 *qed \input7\\lf\41\lf\end
                                12 lines. (a) tape7
                             0               Printer Device
11:01:51 000:09.675          all done
11:01:51 000:09.677      132 *let temp=rplcc(lastmsg," ")
11:01:51 000:09.685      133 *let printerlist=getsym(temp,1)
11:01:51   000:09.691           134  *if  printerlist  .eq.  "printer"  then  let
printerlist="  "
11:01:51 000:09.698      135 *qed \input7\\lf\51\lf\end
                                12 lines. (a) tape7
                             0               Checkpoint Restart Name
11:01:53 000:09.860          all done
11:01:53 000:09.862      136 *let temp=rplcc(lastmsg," ")
11:01:53 000:09.870      137 *let ckpt="no"
11:01:53 000:09.875      138 *let rstdb="no"
11:01:54 000:09.881      139 *let templ=getsym(temp,1)
11:01:54 000:09.887      140 *if templ .ne. "0" then let ckpt="yes"
11:01:54 000:09.894      141 *if ckpt .eq. "yes" then go to skip
                         142 */
11:01:54 000:09.901      143 *qed \input7\\lf\61\lf\end
                                12 lines. (a) tape7
                             0               Database Restart Name
11:01:57 000:10.063          all done
11:01:57 000:10.065      144 *let temp=rplcc(lastmsg," ")
11:01:57 000:10.073      145 *let templ=getsym(temp,1)
11:01:57 000:10.079      146 *if templ .ne. "0" then let rstdb="yes"
                         147 */
11:01:57 000:10.086      148 *skip:
11:01:57 000:10.088      149 *let restartid=getsym(templ,1)
11:01:57 000:10.095      150 *if templ .eq. "0" then let restartid="        "
11:01:57 000:10.104      151 *qed \input7\\lf\71\lf\end
                                12 lines. (a) tape7
                             plate           NASTRAN deck name
11:02:00 000:10.266          all done
11:02:00 000:10.269      152 *let temp=rplcc(lastmsg," ")
11:02:00 000:10.276      153 *let nasdeck=getsym(temp,1)
```

```
11:02:00 000:10.283     154 *qed \input7\\lf\81\lf\end
                                12 lines. (a) tape7
                              2             Execution Time Limit {minutes}
11:02:02 000:10.445           all done
11:02:02 000:10.447     155 *let temp=rplcc(lastmsg," ")

11:02:02 000:10.455 v07/09/87 AFWLCC cosmos 2.4 ar3 001995 mic *** +cosmva0  ***
nasgo james m *** page 6

11:02:02 000:10.459     156 *let maxtime=getsym(temp,1)
11:02:02 000:10.465     157 *qed \input7\\lf\91\lf\end
                                12 lines. (a) tape7
                              1.00          Job Priority  { 1.00 to 1.99 }
11:02:05 000:10.628           all done
11:02:05 000:10.630     158 *let temp=rplcc(lastmsg," ")
11:02:05 000:10.638     159 *let xpriority=getsym(temp,1)
11:02:05 000:10.645     160 *qed \input7\\lf\101\lf\end
                                12 lines. (a) tape7
                              0             Alter Deck Name
11:02:07 000:10.806           all done
11:02:07 000:10.809     161 *let temp=rplcc(lastmsg," ")
11:02:07 000:10.817     162 *let altid=getsym(temp,1)
11:02:07 000:10.823     163 *let altr="no"
11:02:07 000:10.829     164 *if altid .ne. "0" then let altr="yes"
11:02:07 000:10.836     165 *qed \input7\\lf\111\lf\end
                                12 lines. (a) tape7
                              a             Class           { a, b, or c }
11:02:10 000:10.998           all done
11:02:10 000:11.001     166 *let temp=rplcc(lastmsg," ")
11:02:10 000:11.009     167 *let xclass=getsym(temp,1)
11:02:10 000:11.016     168 *qed \input7\\lf\121\lf\end
                                12 lines. (a) tape7
                              1             MSET run?     {0=No, 1=Yes}
11:02:13 000:11.178           all done
11:02:13 000:11.180     169 *let temp=rplcc(lastmsg," ")
11:02:13 000:11.188     170 *let mlset=getsym(temp,1)
```

```
11:02:13 000:11.194      171 *let mmset="no"
11:02:13 000:11.200      172 *if mlset .ne. "0" then let mmset="yes"
                         173 */
                         174 */  >> IF "NASJOB1" IS NOT IN LOCAL SPACE, <<
                         175 */  >> LOOK FOR IT UNDER MASS STORAGE.     <<
                         176 */
11:02:13 000:11.214      177 *let errorfile="nasjobl"
11:02:13 000:11.220      178 *let jclempty="nasjobl"
11:02:13 000:11.227      179 *files \jclempty\
                             none
11:02:15 000:11.339           all done
11:02:15 000:11.341      180 *if lastmsg .has. "none" then mass get \jclempty\
                             000         87/07/09        11:02:46.518          get
nasjobl:/001995/nasjobl
                             001 (246300b bits) 87/07/09 08:47:47.822
11:02:19 000:11.621           all done
11:02:19 000:11.624      181 *files \jclempty\
                                 2463 re  nasjobl
11:02:21 000:11.728           all done
11:02:21 000:11.730      182 *if lastmsg .has. "none" then go to missingfile
                         183 */
                         184 */  >> SET UP PARAMETERS FOR USE IN "NASJOB1" <<
                         185 */
11:02:21 000:11.741      186 *let printerlist='"'_\printerlist\_'"'
11:02:21 000:11.751      187 *let userid='"'_\userid\_'"'

11:02:21 000:11.761 v07/09/87 AFWLCC cosmos 2.4 ar3 001995 mic *** +cosmva0  ***
nasgo james m *** page 7

11:02:21 000:11.765      188 *let coresize='"'_\coresize\_'"'
11:02:21 000:11.775      189 *let copyinput="no"
11:02:21 000:11.781      190 *let jobname="j"_\nasdeck\
11:02:21 000:11.790      191 *let mset='"'_\mmset\_'"'
                         192 */
                         193 */  >>IF NASTRAN DECK IS NOT IN LOCAL FILE SPACE.<<
                         194 */  >> LOOK FOR IT UNDER MASS STORAGE.    <<
```

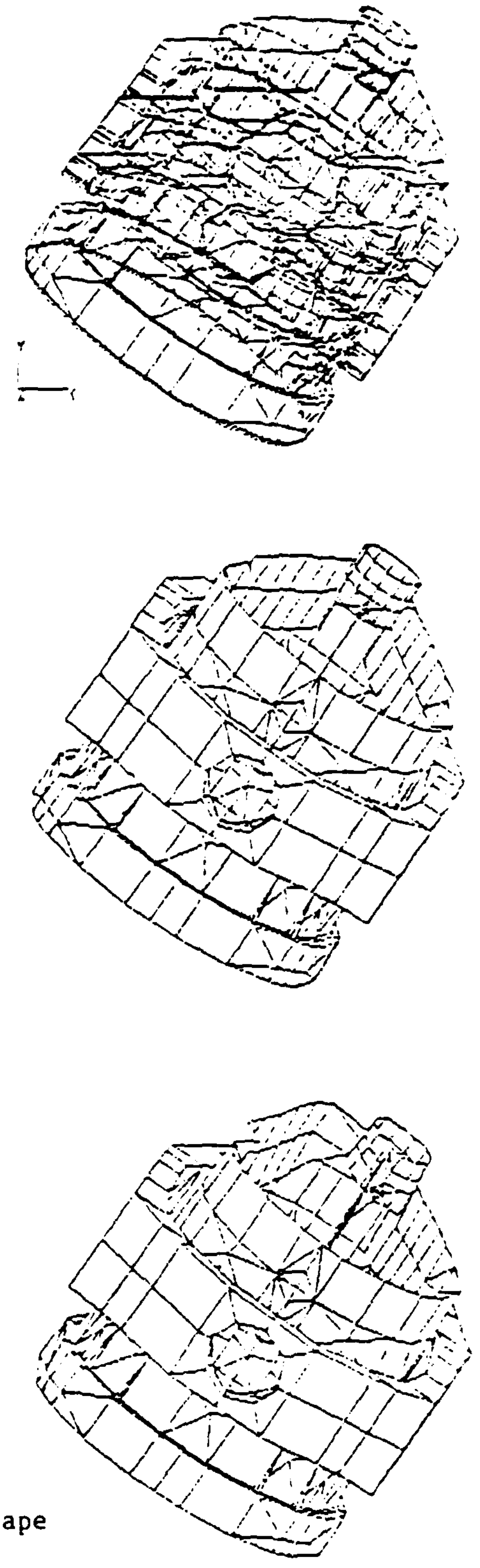
```
                          195 */
11:02:22 000:11.847       196 *let errorfile=\nasdeck\
11:02:22 000:11.853       197 *files \nasdeck\
                                   764 rw  plate
11:02:24 000:11.961            all done
11:02:24 000:11.964       198 *if lastmsg .has. "none" then mass get \nasdeck\
11:02:24 000:11.971       199 *files \nasdeck\
                                   764 rw  plate
11:02:26 000:12.075            all done
11:02:26 000:12.077       200 *if lastmsg .has. "none" then go to missingfile
                          201 */
11:02:26 000:12.085       202 *if \ckpt\ .ne. "yes" then go to shipit
11:02:26 000:12.101       219 *shipit:
                          220 */
                          221 */  >> DESTROY ANY OLD VERSIONS OF THE JOB CONTROL<<
                          222 */  >> FILE FOR THIS NASTRAN DECK.                <<
                          223 */
11:02:26 000:12.107       224 *destrov \jobname\
                              not found:
                                jplate
11:02:28 000:12.211            all done
                          225 */
                          226 */  >> DETERMINE WHETHER THE NASTRAN DECK BEGINS <<
                          227 */  >> WITH A "*DECK" CARD.  IF NOT, INSERT ONE. <<
                          228 */
11:02:28 000:12.219       229 *qed \nasdeck\\lf\ll\lf\end
                                157 lines. (a) plate
                              id weight,test
11:02:31 000:12.401            all done
11:02:31 000:12.404       230 *let temp=rplcc(lastmsg," ")
11:02:31 000:12.412       231 *let firstword=getsym(temp,1)
11:02:31 000:12.419       232 *if firstword .eq. "*deck" then go to skip2
                          233 */
11:02:31 000:12.427       234 *trixgl                o(\nasdeck\)\lf\bll\lf\*deck
                              \nasdeck\\lf\.\end
%missing end \, will supply one.
```

```
                                   157 lines (  80s)
                                        .
%trying to end controllee   end
11:02:34 000:12.718          all done
                         235 */
11:02:34 000:12.722      236 *skip2:
11:02:34 000:12.723      237 *select messages=short
                         238 */
                         239 */  >> DETERMINE WHETHER ALTER LINES EXIST <<

11:02:34 000:12.731 v07/09/87 AFWLCC cosmos 2.4 ar3 001995 mic *** +cosmva0  ***
nasgo james m *** page 8

                         240 */  >> OR ARE NEEDED FOR THIS RUN.          <<
                         241 */  >>(IS THIS A CHECKPOINT OR ALTER LIBRARY RUN?)<<
                         242 */
11:02:35 000:12.779      243 *  if (ckpt .ne. "yes") .and. (altr .ne. "yes") then
                             go to noalters
11:02:35 000:12.838      353 *noalters:
                         354 */
                         355 */  >> MERGE THE NASTRAN DECK INTO THE <<
                         356 */  >> JOB CONTROL FILE (NASJOB1).     <<
                         357 */
11:02:35 000:12.845      358 *trixgl \lf\mf(\nasdeck\ \jclempty\,\jobname\)
                             ok. jplate     merged
11:02:38 000:13.027          all done
11:02:38   000:13.030          359  *trixgl  o(\jobname\)\lf\fp\lf\*select\lf\1%
% %
                               589 lines (  80s)
                             176 *select message=medium,savefiles=none
                             .
                         360 tp1,]\lf\*let coresize=\lf\rl%
                             182 *let coresize="300000"
                             .
                         361 tp1,]\lf\*let userid=\lf\rl%
                             184 *let userid="000000"
```

```
                              362 tpl,]\lf\*let printerlist=\lf\rl%
                                  183 *let printerlist="mfaco"
11:02:49 000:13.938                all done
                              363 */
                              364 */  >> DESTROY THE MODIFIED NASTRAN DECK  <<
                              365 */  >> IF IT WAS CREATED, AND RESTORE THE <<
                              366 */  >> ORIGINAL UNALTERED COPY.           <<
                              367 */
11:04:05 000:13.988           368 *if \copyinput\ .eq. "no" then go to noextrainput
11:04:05 000:13.998           372 *noextrainput:
                              373 */
11:04:05 000:14.001           374 *if \ckpt\ .eq. "no" then go to dbrcheck
11:04:06 000:14.054           382 *dbrcheck:
11:04:06 000:14.056           383 *if \rstdb\ .eq. "no" then go to endjclprp
11:04:06 000:14.083           427 *endjclprp:
                              428 */
                              429 */  >> IF NO ERRORS HAVE BEEN ENCOUNTERED, <<
                              430 */  >> SUBMIT THE JOB.                     <<
                              431 */
11:04:06 000:14.089           432 *mass store tape7
                                  000 87/07/09 11:04:37.649  store tape7:/001995/tape7
                                  001 (7300b bits)
11:04:11 000:14.400                all done
11:04:11 000:14.402           433 *destroy alwith. %%% %
11:04:12 000:14.454                all done
11:04:12 000:14.456           434 *if \iero\ .eq. "yes" then go to flagerror
                              435 */
11:04:12         000:14.466                         436         *submit
i=\jobname\,t=\maxtime\,p=\xpriority\,class=\xclass\ end
                                  jplate was submitted.

11:04:16 000:14.669 v07/09/87 AFWLCC cosmos 2.4 ar3 001995 mic *** +cosmva0  ***
nasgo james m *** page 9

11:04:16 000:14.672                all done
```

```
                        437 */
                        438 */  !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
                        439 */  >> THE JOB HAS BEEN SUBMITTED <<
                        440 */  !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
                        441 */
11:04:17 000:14.722     442 *go to theend
11:04:17 000:14.727     450 *theend:
11:04:17 000:14.728     451 *destroy tape8 \jobname\ nasjobl ratsexe data
                            not found:
                                tape8  ratsexe     data
11:04:19 000:14.835          all done
11:04:19 000:14.837     452 *aborted:
11:04:19 000:14.838         > end cosmos run **********

 all done
files
    6014 rw logmlgy3
    2744 re nasgo
  107615 re nasprgex
    1011 rw plate
      73 rw tape7

 all done
status j=jplate

division ar3/ata(999917,999918,999919,999920,999922,999923)

job       user   date   time  state r  limit  d tid      c  pri

jplate   001995 07/09 08:43:21 ran  3    .72 00          a 1.00
jplate   001995 07/09 11:13:23 ran  3    .77 00          a 1.00

 all done
files
    6014 rw  logmlgy3
    5526 rw  logtlgy3
```

```
     2744 re  nasgo
   107615 re  nasprgex
     1011 rv  plate
       73 rv  tape7

  all done
 mass list

    node name: 001995
    descendants:
        jclnast
        jclprep
        nastexe
        ratsexe
        nastplot
        plotexe
        pltprep
        npatexe
        nasgo
        nasgo1
        nasgo2
        nasprgex
        nasaltr
        nasprg
        naspat
        naspatex
        nasvax
        nasjob1
        nasjob2
        apc
        cpat
        tape999
        tape909
        tape199
        pltx
        mhdcbe
       mhdcb1
       output            dir
       nasaltrs
       nasmodel
       nasgold2
       nasgold1
       nmodel.
       mset.for
       mset
       plate
       tape7
       dbplate           dir
       tape6
       mplate
       oplate
       aplate

all done
```



Demo Model

Wire Mesh Model

Hidden Line Model

Hidden Line Deformed Shape

Figure 3. PATRAN Renderings of Example Model.

ACRONYMS

CFS	Common File System - file storage for the CRAY (an IBM machine)
COSMOS	CRAY procedure language
CTSS	CRAY operating system
DMAP	Direct Matrix Abstraction Program - Program used to alter NASTRAN execution (usually for modified output)
GATEWAY	Program and network to transfer models and output from VAX to CRAY and CRAY to VAX
NASALTR	File containing DMAP statements for various outputs from NASTRAN
NASGO	Procedure program to set up and submit NASTRAN job
NASGO2	Procedure program to submit NASPAT job
NASJOB1	Input procedure modified by NASGO to execute NASTRAN
NASJOB2	Input procedure modified by NASGO2 to execute NASPAT
NASPAT	Translation program to convert NASTRAN results to PATRAN format
NASPRGEX	Program to add user parameters to NASTRAN input
NASTRAN	Multi-purpose finite element analysis program
MODAL.COM	Procedure program to convert models and results to appropriate format
MODAL.FOR	Program to convert PATRAN ASCII results file into PATRAN binary results file
PATRAN	Pre- and post-processor for NASTRAN

FILE TRANSFER AND PATRAN EXECUTION ON THE SILICON GRAPHICS

The files shown as output from NASTRAN on the CRAY (NASPTDAT) and the NASTRAN source file need to be transferred to the Silicon Graphics, from the VAX. The files must not be in STEXT or binary format. NASPTDAT is in STEXT format once it has been retrieved from mass storage to the VAX. NTEXT the file and call it some filename you can remember for transfer to the Silicon Graphics. If the source deck for NASTRAN is on the VAX in ASCII format (non-binary and non-STEXT) then it is also ready for transfer to the Silicon Graphics. If the file is only resident on the CRAY, then it must be put in STEXT format on the CRAY, stored in mass storage, retrieved on the VAX, and put in NTEXT format on the VAX prior to transfer to the Silicon Graphics. The following writeups are examples of how to retrieve files and transfer them to the Silicon Graphics. The discussion of how to run PATRAN on the Silicon Graphics is not covered here. Executing PATRAN is covered in the "PATRAN User's Guide".

To transfer files from the VAX to the Silicon Graphics:

While on the Silicon Graphics:

```
Type: connect
     Log in on the VAX
Type: write sysSoutput "~>:filename-on-iris"
```

The following two lines of commands will not be echoed to the screen!

```
Type: filename-on-VAX
Type: write sysSoutput "~>"
Logoff the VAX.
Type: ~.
```

This will transfer the file from the VAX to the IRIS. Once there the file is ready for additional processing. This processing is performed with either NASPAT (for the source deck) or MODAL (for the results file).

To translate a source file to PATRAN format:

Type: NASPAT

Follow the prompts to translate a source deck into PATRAN format.

To translate a results file to PATRAN format:

Type: MODAL

Follow the prompts to translate the results file into the separate animation files in PATRAN format.

APPENDIX

Modal Strain Energy Tabulation (MSET)

1. Introduction

The modal strain energy method was developed for design analysis of viscoelastic damping treatments (Refs. A-1, A-2, A-3). Using this method, the designer seeks to maximize the modal strain energy in the viscoelastic treatment as a fraction of the total strain energy. While this information has been available from MSC/NASTRAN for many years in printed form, the form is not convenient. In addition to the total viscoelastic strain energy fraction, designers typically want to sum strain energies in several separate regions where damping may be applied. These calculations are typically required for several normal modes.

In response to this need, a program called MSET ("Modal Strain Energy Tabulation") was written (Ref. A-4). While the program is intended primarily for damping design, it is also useful in other normal modes analyses for evaluating mode shapes. MSET runs as a post processing step after a NASTRAN Solution 63 analysis. The user specifies groups of elements, such as viscoelastic areas, constraining layers, etc. Modal strain energies for all modes, or selected modes, are then broken down into the specified groups and displayed in tabular form. As an alternative, users may also display kinetic energy fractions organized by groups of node points to further aid in evaluating mode shapes. The code operates by reading user commands either interactively or in batch mode and producing a tabulated listing as a result. After the NASTRAN run has been completed, MSET may be run repeatedly with different user input.

MSET requires a DMAP alter, which is inserted into the NASTRAN Solution 63 normal modes run. This alter causes NASTRAN to write binary files containing modal strain energies and other information. MSET reads these files and accepts commands either interactively or from a batch mode command file, which cause it to output tabulated data on another file.

2. Executing MSET

MSET was originally written for VAX computers, with NASTRAN and MSET both running on the same machine. At the Air Force Weapons Laboratory (AFWL), NASTRAN runs on the Cray. It might have been possible to install MSET on the Cray for interactive execution on that machine. However, it was felt that interactive execution on a VAX would be more convenient, especially when graphic displays are produced. This choice also made it unnecessary to convert all of MSET from VAX to Cray Fortran. Furthermore, the focus of the present contract was on finding better ways for NASTRAN users to use the VAX and Cray computers cooperatively, and to transfer data between them.

MSET as originally written used binary files written by NASTRAN in its OUTPUT2 and OUTPUT4 formats. Running MSET entirely on the AR VAX would require transmission of the binary files written by NASTRAN from the Cray to the VAX. One aspect of this project was to investigate transmission of binary files between the Cray and the VAX, as documented in Reference A-5. Although the NOSTRADAMUS code (which is intended to transmit binary files) was obtained, this approach was not followed. Thus it was necessary to write a small Fortran code, using parts of MSET, and install it on the Cray. This code simply reads the binary files created by NASTRAN and writes the data to an ASCII file which is transferred to the VAX using the normal STEXT/mass-store/mass-get/NTEXT sequence discussed in Reference A-5. This post processing step is scheduled in the same batch run with NASTRAN, provided the user requests MSET processing when setting up the run using NASGO.

After the run has been completed successfully, the user can return to the VAX and retrieve the ASCII file and run MSET either interactively or in batch mode.

3. Using MSET on the VAX

MSET runs on VAX computers and is normally invoked by the DCL command "MSET." This symbol must be defined either in a user's LOGIN.COM file or in the system-wide login file. MSET may be run either interactively or in batch mode. In interactive mode, commands are typed directly at the terminal. In batch mode, commands are inserted in an indirect command file which MSET reads. Most users prefer batch mode because they often want to repeat the same set of commands for different runs or make minor changes with a text editor.

For interactive mode, the DCL command is simply

```
$ MSET
```

Using batch mode, one writes commands into a file with the extension .IND and submits this file to MSET by typing

```
$ MSET filename
```

where `filename` is the command file name, without the .IND extension. An optional qualifier, `queue`, is the name of the desired batch queue (default SYS$BATCH).

```
$ MSET filename/QUE=queue
```

MSET operates by building tables of strain energies in which each row represents a set of elements and each column represents a particular normal mode. As an option, MSET will sort elements in order of decreasing strain energy and print another table showing the first few elements in the sorted list (see SET DENSITY_NUMBER below). If kinetic energies are calculated, MSET will also sort grid points in order of decreasing kinetic energy and display the first few grids in this table (see SET KE). Tables are built internally and are then written to a file which can be printed or displayed.

MSET commands should be given in the following sequence:

1. The NASFILE command, to get MSET to read data from NASTRAN.

2. Optional commands to generate headers for the table: TITLE, SUBTITLE, VEMT, VEMG, CLT, CLE, SET string.

3. The MODES command, to select a set of normal modes for which strain energies are to be calculated.

4. One or more SUM commands or a NASSET command to select a set of elements to use in calculating a single row of the table.

5. An optional LABEL command used to label the row being generated.

6. A CALCULATE command to cause MSET to carry out the calculation for a single row, using elements chosen by SUM or NASSET commands, and enter the row in the table. Any number of rows may be generated by entering successive sets of SUM or NASSET commands (and optional LABEL commands) followed by a CALCULATE command.

7. A STORE command to write the internally generated table to a file. After the STORE command, a new table may be generated by returning to step 1 or step 2.

8. An EXIT command must always be the final command.

At any point between the NASSET and EXIT commands, various SET and SHOW commands may be entered. Also, comment lines may appear at any point, beginning with an exclamation point (!).

As mentioned before, MSET may also be used to tabulate kinetic energies. In this case, the procedure is the same except that GRID commands are used instead of SUM commands to select sets of grid points instead of sets of elements, and the PUT_KE command is used instead of the CALCULATE command to store an individual line in the table.

Following are detailed descriptions of individual MSET commands:

```
NASFILE filename
```

The filename is the complete name (including extension) of the ASCII file that has been transferred from the Cray. MSET looks for filename.OUS and filename.MAS. The first file is required. It contains both LAMA and an ONRGY1 table and is written by NASTRAN DMAP alters in SOLution 63. A NASFILE command must appear prior to any other commands. If a filename.MAS is also found then the structure's mass and center of gravity will be calculated and displayed in the table. Filename.MAS must exist for kinetic energy calculation.

```
NASSET filename
```

filename is the name of a .SET file through which element numbers may be specified.

```
MODES 1,2,3,7,8
MODES 2 THRU 8 EXCEPT 5
MODES ALL
```

MODES selects modes for which strain energies will be calculated.

```
KEMODES 1,2,3,7,8
KEMODES 2 THRU 8 EXCEPT 5
KEMODES ALL
```

KEMODES selects modes for which kinetic energies will be calculated.

```
TITLE 'string'
```

string is a title for the table (up to 128 characters). "Percent Strain Energies" is the default title.

```
SUBTITLE 'string'
SUBTITLE 'string' n
```

'string' is a subtitle for the table (up to 128 characters). If a number n follows string, then string will be the n'th subtitle. Otherwise, successive subtitles will appear in the output table in the order in which the SUBTITLE commands are given.

```
LABEL 'string'
LABEL 'string' n
```

string is a label for a table row (up to 32 characters). If a number n follows string, then string will label the row corresponding to "n." Otherwise, string will label the row following the last calculated row.

```
SUM 1000,1010,1020
SUM 10 THRU 500 EXCEPT 100 THRU 200
SUM ALL EXCEPT 50 THRU 1000,5000,5050
SUM HEXA
SUM SET n
SUM HEXA EXCEPT 1050,1060,1070
SUM QUAD4,BAR
```

SUM sets flags in the element table to include or exclude particular elements in a calculation. The SUM SET command above refers to set n within a NASSET file that has previously been opened with the NASSET command. It will flag all elements within set n for inclusion within the next calculation. All other numbers used in the SUM command are element numbers.

```
SHOW TABLE
SHOW MODE
SHOW TITLE
SHOW LABEL
SHOW SUM
SHOW GRIDS
SHOW KE
SHOW LAST_COMMAND
SHOW LAST_MESSAGE
SHOW DATE
SHOW TIME
```

SHOW lets the user examine the table and various states from within the program. SHOW TABLE shows the table exactly as it would appear if sent to a printer. SHOW MODE shows the modes within the NASTRAN file, as well as which modes will be included the table and calculations. SHOW SUM shows which elements have been detected in the NASTRAN file, as well as each element's status for inclusion in the next calculation. SHOW GRIDS shows the grids found within the NASTRAN file, as well as which grids will be included in the table with the PUT_KE command. SHOW KE shows the percent kinetic energies for the grids chosen with the GRIDS command.

```
CALCULATE
```

CALCULATE sums the percent strain energies for all flagged elements for each flagged mode and then clears all the element flags prior to the next calculation.

```
GRIDS 1000,1010,1020
GRIDS 100 THRU 999
GRIDS ALL EXCEPT 2000 THRU 50000
```

GRIDS sets flags in the grid table to include, or not include, grids in the table when the PUT_KE command is given. Note, the setting of the grid flags will not affect the calculation of percent kinetic energies, i.e., percent kinetic energies are calculated using all grid points (but no scalar points). GRIDS has no effect on the output of the maximum percent kinetic energies as designated by the SET KE command below.

```
PUT_KE
```

PUT_KE inserts into the table a listing of the percent kinetic energies of all grids set by the GRIDS command for all modes set by KEMODES. The kinetic energies at each of the six degrees of freedom for each gridpoint are displayed.

```
STORE filename
```

filename is the name of a file where the percent strain energy table is stored.

```
DELETE n
```

n is the row number in the percent strain energy table that is permanently removed from the table.

```
SET PROMPT 'string'
SET DENSITY_NUMBER n
SET KE m
```

string is a character string to be used as the program prompt (up to eight characters). The number n controls the second part of the table, in which strain energies are sorted and the first n elements are printed. Similarly, m controls the third part, in which kinetic energies (if any) are sorted, and the m points having maximum values are printed. The SET KE command is independent of the GRIDS and PUT_KE commands, i.e., a particular grid point may be printed more than once per mode in the table if it has the highest absolute kinetic energies in more than one degree of freedom. (m=0, n=0, and string='*' are the defaults.)

```
VEMT [n] = number
VEMG [n] = number
CLT [n] = number
CLE [n] = number
SET string = number
```

These commands will report the value of the indicated viscoelastic property at the top of the strain energy table under the "Mass =" line. string is any property variable name. number is the value to be printed, and it must appear in standard "F," "E," or "I" format. n is an optional subscript value between 1 and 5 used to display values for more than one of a particular property.

```
EXIT
```

EXIT exits the program.

```
@filename
```

filename is the name of an indirect command file that may contain MSET commands. The file name must have the extension ".IND." Any line within filename.IND that starts with an exclamation point (!) is considered a comment line and is ignored.

4. Special Instructions for MSET

The following special instructions must be observed in using MSET on the AFWL Cray and the AR VAX computers:

1. The MSET option (option 12) must be chosen when running NASGO. Reference A-5 explains NASGO.

2. SOLution 63 must be selected.

3. The MSET alter for version 63 must be included. The alter is available as part of the alter library used by NASGO, and instructions on thc use of alters may be found in Reference A-5.

4. The case control deck must include the line

   ```
   ESE=ALL
   ```

   The alter suppresses printout of element strain energies by changing the default value of PARAM,TINY to 99 percent. If element strain energy printout is desired, PARAM,TINY should be set back to a small value such as 10^{-3}. See section 3.1 of Reference A-6 for more about PARAM,TINY.

5. After the NASTRAN run has been concluded, the COSMOS control program invoked by NASGO will have stored the MSET data file in mass storage under the name Mjob, where "job" is the name of the job that was specified to NASGO. That is, if the job name was PLATE, then MPLATE will be stored. This file must be fetched back to the AR VAX using MASS and converted using NTEXT.

5. Typical Output

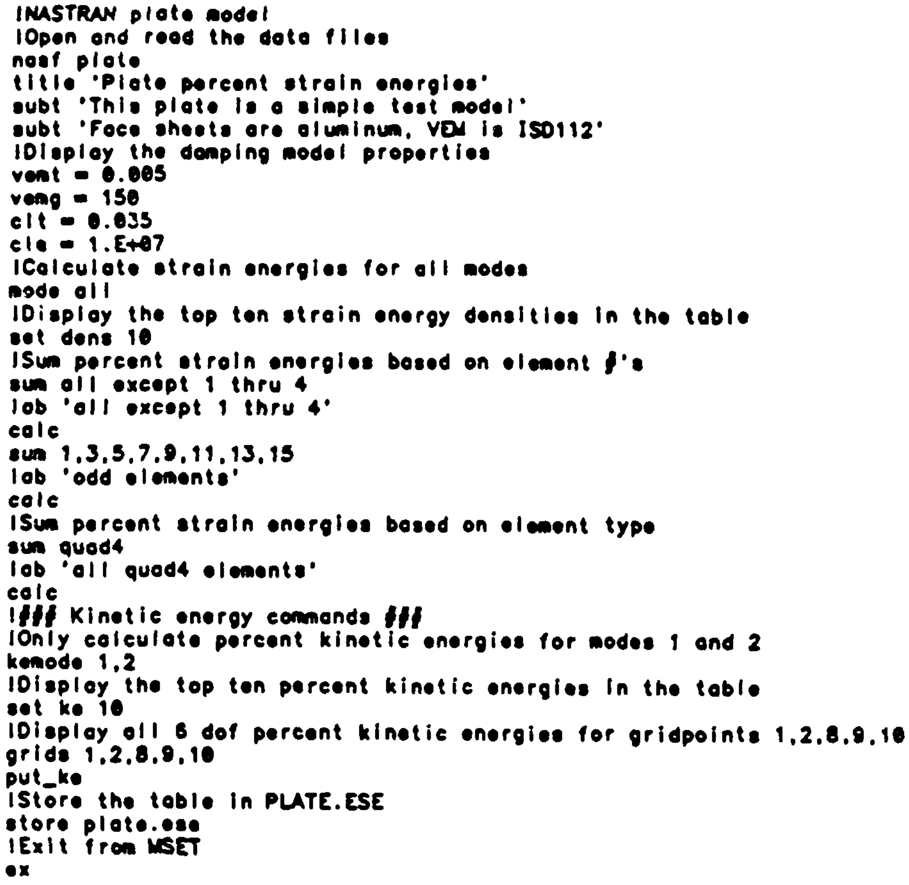
Figure 1 shows PLATE.IND, a typical input file for MSET. To run this, one would type

```
$ MSET PLATE
```

or

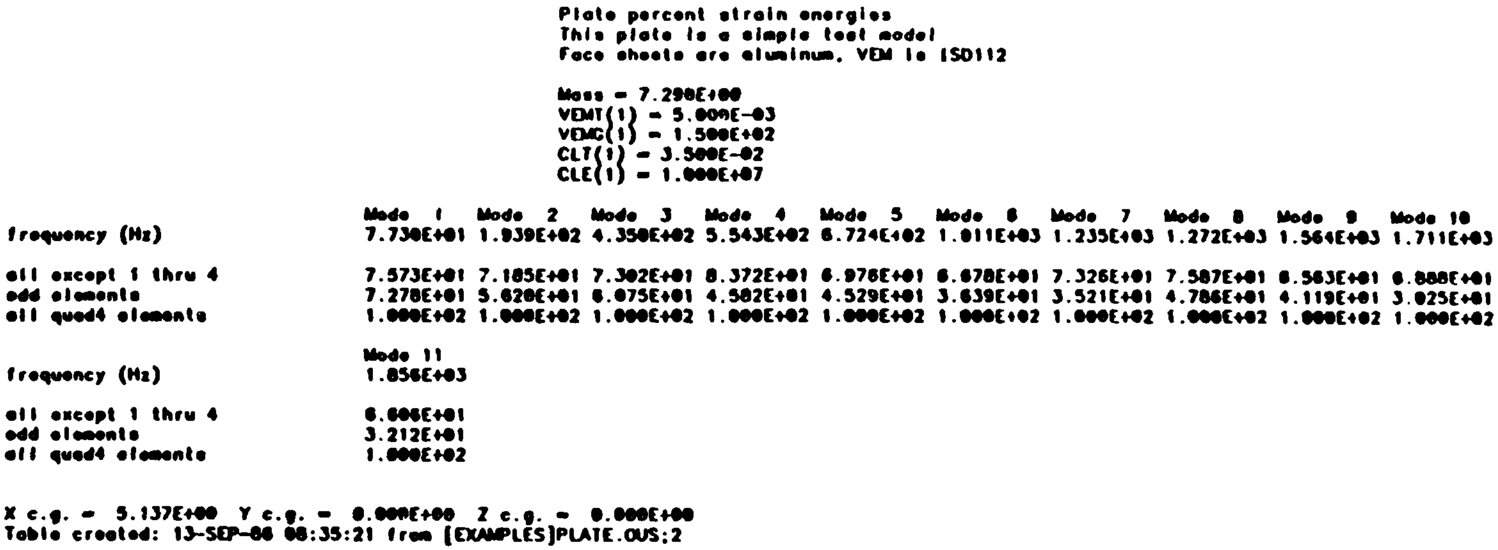
```
$ MSET
@PLATE
EXIT
```

Figure 2 shows strain energy output as requested by the SUM commands. Figure 3 shows sorted strain energies, one row for each mode. Figure 4 shows kinetic energies sorted by individual degrees of freedom and also by grid point.



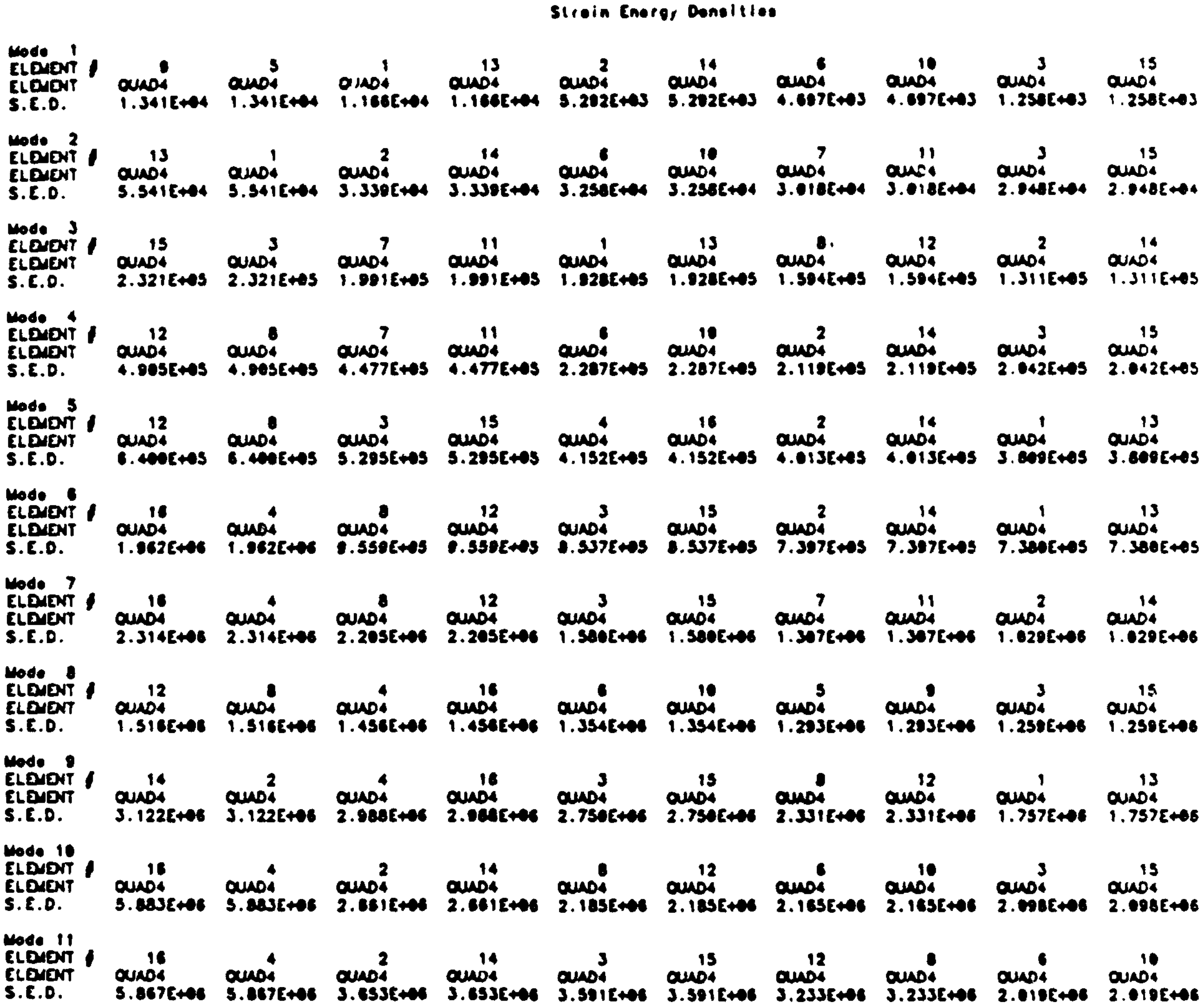
```
!NASTRAN plate model
!Open and read the data files
nasf plate
title 'Plate percent strain energies'
subt 'This plate is a simple test model'
subt 'Face sheets are aluminum, VEM is ISD112'
!Display the damping model properties
vemt = 0.005
vemg = 150
clt = 0.035
cle = 1.E+07
!Calculate strain energies for all modes
mode all
!Display the top ten strain energy densities in the table
set dens 10
!Sum percent strain energies based on element #'s
sum all except 1 thru 4
lab 'all except 1 thru 4'
calc
sum 1,3,5,7,9,11,13,15
lab 'odd elements'
calc
!Sum percent strain energies based on element type
sum quad4
lab 'all quad4 elements'
calc
!### Kinetic energy commands ###
!Only calculate percent kinetic energies for modes 1 and 2
kemode 1,2
!Display the top ten percent kinetic energies in the table
set ke 10
!Display all 6 dof percent kinetic energies for gridpoints 1,2,8,9,10
grids 1,2,8,9,10
put_ke
!Store the table in PLATE.ESE
store plate.ese
!Exit from MSET
ex
```

Figure 1. Typical MSET input



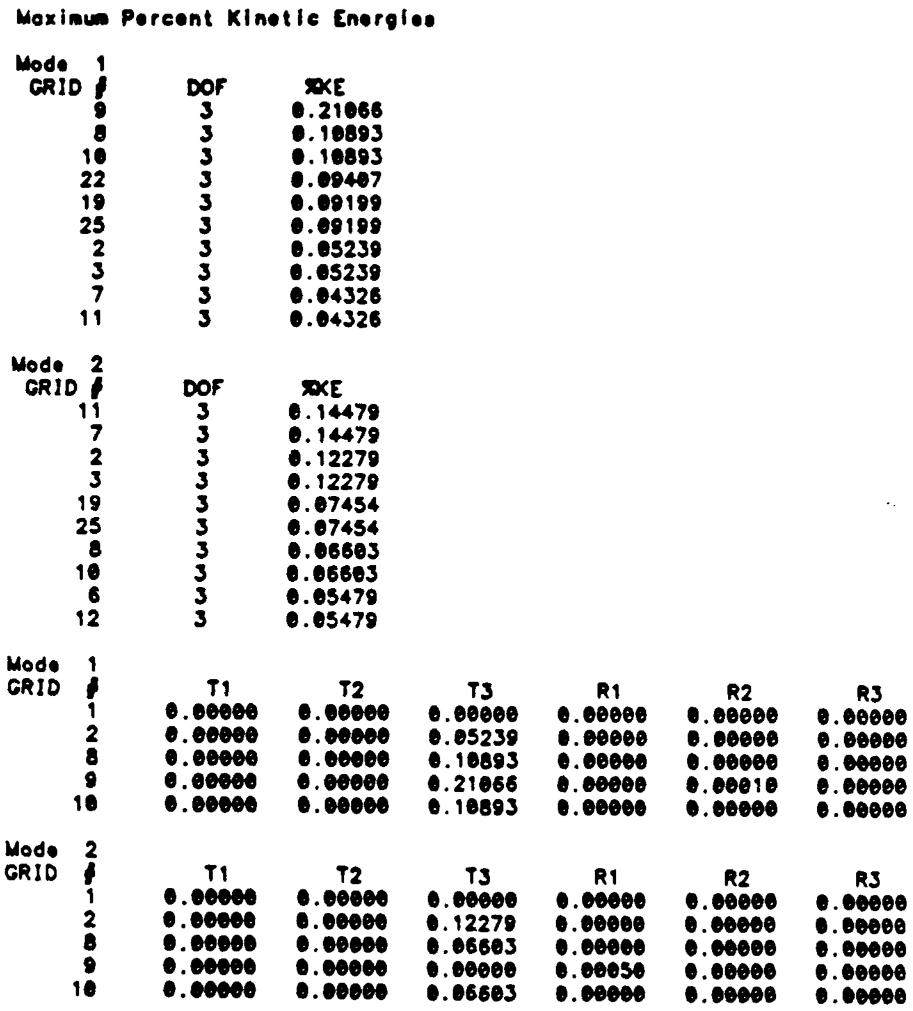
```
                                           Plate percent strain energies
                                           This plate is a simple test model
                                           Face sheets are aluminum, VEM is ISD112

                                           Mass = 7.290E+00
                                           VEMT(1) = 5.009E-03
                                           VEMG(1) = 1.500E+02
                                           CLT(1) = 3.500E-02
                                           CLE(1) = 1.000E+07

                          Mode  1   Mode  2   Mode  3   Mode  4   Mode  5   Mode  6   Mode  7   Mode  8   Mode  9   Mode 10
frequency (Hz)            7.730E+01 1.939E+02 4.350E+02 5.543E+02 6.724E+02 1.011E+03 1.235E+03 1.272E+03 1.564E+03 1.711E+03

all except 1 thru 4       7.573E+01 7.185E+01 7.302E+01 8.372E+01 6.976E+01 6.678E+01 7.326E+01 7.587E+01 8.563E+01 6.888E+01
odd elements              7.278E+01 5.620E+01 6.075E+01 4.582E+01 4.529E+01 3.639E+01 3.521E+01 4.786E+01 4.119E+01 3.025E+01
all quad4 elements        1.000E+02 1.000E+02 1.000E+02 1.000E+02 1.000E+02 1.000E+02 1.000E+02 1.000E+02 1.000E+02 1.000E+02

                          Mode 11
frequency (Hz)            1.856E+03

all except 1 thru 4       6.606E+01
odd elements              3.212E+01
all quad4 elements        1.000E+02

X c.g. =  5.137E+00  Y c.g. =  0.000E+00  Z c.g. =  0.000E+00
Table created: 13-SEP-86 08:35:21 from [EXAMPLES]PLATE.OUS;2
```

Figure 2. Typical MSET strain energy table



```
                                                  Strain Energy Densities

Mode  1
ELEMENT #      9          5          1          13         2          14         6          10         3          15
ELEMENT     QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4
S.E.D.      1.341E+04  1.341E+04  1.166E+04  1.166E+04  5.202E+03  5.202E+03  4.697E+03  4.697E+03  1.258E+03  1.258E+03

Mode  2
ELEMENT #      13         1          2          14         6          10         7          11         3          15
ELEMENT     QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4
S.E.D.      5.541E+04  5.541E+04  3.339E+04  3.339E+04  3.258E+04  3.258E+04  3.018E+04  3.018E+04  2.948E+04  2.948E+04

Mode  3
ELEMENT #      15         3          7          11         1          13         8          12         2          14
ELEMENT     QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4
S.E.D.      2.321E+05  2.321E+05  1.991E+05  1.991E+05  1.828E+05  1.828E+05  1.594E+05  1.594E+05  1.311E+05  1.311E+05

Mode  4
ELEMENT #      12         8          7          11         6          10         2          14         3          15
ELEMENT     QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4
S.E.D.      4.905E+05  4.905E+05  4.477E+05  4.477E+05  2.287E+05  2.287E+05  2.119E+05  2.119E+05  2.042E+05  2.042E+05

Mode  5
ELEMENT #      12         8          3          15         4          16         2          14         1          13
ELEMENT     QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4
S.E.D.      6.400E+05  6.400E+05  5.295E+05  5.295E+05  4.152E+05  4.152E+05  4.013E+05  4.013E+05  3.809E+05  3.809E+05

Mode  6
ELEMENT #      16         4          8          12         3          15         2          14         1          13
ELEMENT     QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4
S.E.D.      1.962E+06  1.962E+06  9.559E+05  9.559E+05  8.537E+05  8.537E+05  7.397E+05  7.397E+05  7.380E+05  7.380E+05

Mode  7
ELEMENT #      16         4          8          12         3          15         7          11         2          14
ELEMENT     QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4
S.E.D.      2.314E+06  2.314E+06  2.205E+06  2.205E+06  1.580E+06  1.580E+06  1.307E+06  1.307E+06  1.029E+06  1.029E+06

Mode  8
ELEMENT #      12         8          4          16         6          10         5          9          3          15
ELEMENT     QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4
S.E.D.      1.516E+06  1.516E+06  1.456E+06  1.456E+06  1.354E+06  1.354E+06  1.293E+06  1.293E+06  1.259E+06  1.259E+06

Mode  9
ELEMENT #      14         2          4          16         3          15         8          12         1          13
ELEMENT     QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4
S.E.D.      3.122E+06  3.122E+06  2.988E+06  2.988E+06  2.750E+06  2.750E+06  2.331E+06  2.331E+06  1.757E+06  1.757E+06

Mode 10
ELEMENT #      16         4          2          14         8          12         6          10         3          15
ELEMENT     QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4
S.E.D.      5.883E+06  5.883E+06  2.861E+06  2.861E+06  2.185E+06  2.185E+06  2.165E+06  2.165E+06  2.098E+06  2.098E+06

Mode 11
ELEMENT #      16         4          2          14         3          15         12         8          6          10
ELEMENT     QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4      QUAD4
S.E.D.      5.867E+06  5.867E+06  3.653E+06  3.653E+06  3.591E+06  3.591E+06  3.233E+06  3.233E+06  2.019E+06  2.019E+06
```

Figure 3. Sorted strain energy output



```
Maximum Percent Kinetic Energies

Mode  1
 GRID #         DOF       %KE
      9          3       0.21066
      8          3       0.10893
     10          3       0.10893
     22          3       0.09407
     19          3       0.09199
     25          3       0.09199
      2          3       0.05239
      3          3       0.05239
      7          3       0.04326
     11          3       0.04326

Mode  2
 GRID #         DOF       %KE
     11          3       0.14479
      7          3       0.14479
      2          3       0.12279
      3          3       0.12279
     19          3       0.07454
     25          3       0.07454
      8          3       0.06603
     10          3       0.06603
      6          3       0.05479
     12          3       0.05479

Mode  1
GRID  #        T1         T2         T3         R1         R2         R3
      1     0.00000    0.00000    0.00000    0.00000    0.00000    0.00000
      2     0.00000    0.00000    0.05239    0.00000    0.00000    0.00000
      8     0.00000    0.00000    0.10893    0.00000    0.00000    0.00000
      9     0.00000    0.00000    0.21066    0.00000    0.00010    0.00000
     10     0.00000    0.00000    0.10893    0.00000    0.00000    0.00000

Mode  2
GRID  #        T1         T2         T3         R1         R2         R3
      1     0.00000    0.00000    0.00000    0.00000    0.00000    0.00000
      2     0.00000    0.00000    0.12279    0.00000    0.00000    0.00000
      8     0.00000    0.00000    0.06603    0.00000    0.00000    0.00000
      9     0.00000    0.00000    0.00000    0.00050    0.00000    0.00000
     10     0.00000    0.00000    0.06603    0.00000    0.00000    0.00000
```

Figure 4. Sorted kinetic energy output

6. References

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A-2 Johnson, C.D., Kienholz, D.A., and Parekh, J.C., "Design Methods for Viscoelastically Damped Plates," *Proc. 24th Structures, Structural Dynamics and Materials Conf.*, Lake Tahoe, NV, May 1983.

A-3 Johnson, C.D., "Design and Analysis of Damped Structures using Finite Element Techniques," ASME Paper No. 85-DET-131, Conference on Mechanical Vibration and Noise, Cincinnati, OH, September 1985.

A-4 Fowler, B.L., "MSET User's Manual," CSA Engineering Report No. 87-04-04, April 1987.

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